

AMENDMENTS TO THE SPECIFICATION:

Please amend SUMMARY OF THE INVENTION section of the specification as indicated below.

Therefore, the present invention addresses such problems, with an object of providing an engine exhaust gas purification apparatus in which clogging in an injection nozzle, which supplies a reducing agent to an exhaust gas flow on an upstream side of a reduction catalyst is prevented, and the mixing proportion of the reducing agent and the exhaust gas is improved, and the efficiency of NOx purification processing is improved.

In accordance with a first aspect of the invention ~~as claimed in claim 1~~, there is provided an exhaust gas purification apparatus of an engine which comprises a reduction catalyst, which is arranged in an exhaust system of an engine, for reducing and purifying nitrogen oxide in an exhaust gas using a reducing agent; and a reducing agent supply device having a tip end portion of an injection nozzle which extends towards a downstream side in an exhaust gas passage of the exhaust system, substantially in parallel with an exhaust gas flow direction, for supplying the reducing agent to an exhaust gas flow on an upstream side of the reduction catalyst; wherein on an exhaust gas downstream side end portion of a tip end portion of the injection nozzle, an exhaust gas downstream side end surface is blocked, and a ring shaped protruding ridge is provided on an outer peripheral surface, and an injection hole is provided in the protruding ridge portion for injecting the reducing agent in an outward direction from an axial center of the injection nozzle.

According to such a construction, the end face of the exhaust gas downstream side end portion of the tip end portion of the injection nozzle extending substantially in parallel with the

exhaust gas flow direction towards the downstream side in the exhaust gas passage of the exhaust system is blocked, and the injection hole provided in the ring shaped protruding ridge portion provided on the outer peripheral surface thereof, ejects the reducing agent in an outward direction from an axial center of the injection nozzle. As a result, the reducing agent is ejected on the exhaust gas upstream side of the reduction catalyst.

In accordance with a second aspect of the invention ~~according to claim 2~~, there is provided a plurality of the injection holes, which are drilled in a radial pattern in an outward direction from the axial center of the tip end portion of the injection nozzle. As a result, the injection holes substantially evenly eject the reducing agent into all regions inside the exhaust gas passage of the exhaust system.

In accordance with a third aspect of the invention ~~according to claim 3~~, the aforementioned injection hole is drilled diagonally in a direction tilted towards the downstream side with respect to the exhaust gas flow direction. As a result, the injection hole ejects the reducing agent in a diagonal direction on the downstream side.

In accordance with a fourth aspect of the invention ~~according to claim 4~~, the aforementioned ring shaped protruding ridge is formed in a shape that is tapered towards an outer peripheral surface. As a result, a flat surface portion in the vicinity of the injection hole provided on the ring shaped protruding ridge portion is narrowed, so that when ejection from the injection nozzle stops, the reducing agent does not become attached to or deposited on the narrow region around the injection hole or holes and does not remain there, or the amount of the remaining reducing agent becomes smaller.

According to the configuration of the first aspect of the invention ~~according to claim 1~~, a reducing agent can be ejected in an outward direction from the axial center of an injection

nozzle, from injection holes provided in a ring shaped protruding ridge portion provided on the outer peripheral surface of the exhaust gas downstream side end portion of the tip end portion of the injection nozzle, and the reducing agent can be ejected on the exhaust gas upstream side of the reduction catalyst. In this case, since the injection holes are formed in the ring shaped protruding ridge portion provided on the outer peripheral surface of the tip end portion of the injection nozzle, and do not directly open on a wide outer peripheral surface of the injection nozzle, then when injection stops the reducing agent does not become attached to or does not remain in the narrow region around the injection holes, or even if it becomes attached, the amount is small corresponding to the narrow region. Consequently, the reducing agent does not enter into the injection holes of the injection nozzle, so that clogging can be prevented.

Therefore, the efficiency of NOx purification processing can be improved.

Furthermore, according to the configuration of the second aspect of the invention according to claim 2, the reducing agent can be substantially evenly ejected into all regions inside the exhaust gas passage of the exhaust system, from the plurality of injection holes drilled in the tip end portion of the injection nozzle in a radial pattern directed outward from the axial center. Consequently, a mixing proportion of the reducing agent and the exhaust gas can be improved. Therefore, the efficiency of NOx purification processing can be improved.

Furthermore, according to the configuration of the third aspect of the invention according to claim 3, the reducing agent can be ejected in a diagonal direction on the downstream side, from the injection holes drilled inclined in a diagonal direction towards the downstream side with respect to the exhaust gas flow direction. At this time, the reducing agent ejected in a diagonal direction flows along the exhaust gas flow, preventing the reducing agent from becoming attached to the internal surface of the exhaust gas passage, and even in the case where the

amount of exhaust gas is small, the reducing agent and exhaust gas are brought in good contact, and the mixing proportion thereof can be improved. Therefore, the efficiency of NOx purification processing can be improved.

Moreover, according to the configuration of the fourth aspect of the invention according to claim 4, due to the ring shaped protruding ridge formed in a shape that is tapered towards the outer peripheral surface, the flat surface portion in the vicinity of the injection holes are narrowed, and the reducing agent does not become attached to or does not remain in the narrowed region around the injection holes when injection from the injection nozzle stops, or the remaining amount thereof becomes small. Accordingly, clogging in the injection holes of the injection nozzle can be better prevented. Therefore, the efficiency of NOx purification processing can be improved.